

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln. No: 10/516,438
Applicant: Kassim Juma
Filed: November 30, 2004
Title: FILTER DEVICE FOR MOLTEN STEEL FILTRATION
T.C./A.U.: 1797
Examiner: Benjamin M. Kurtz
Confirmation No.: 5503
Docket No.: SUD-104US

Commissioner for Patents
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DECLARATION OF DR. KASSIM JUMA PURSUANT TO 37 CFR §1.132

I, Kassim Juma, hereby swear and state that:

- 1) All statements herein made of my knowledge are true and statements made on information and belief are believed to be true.
- 2) I have been active in research and development in the fields of ceramics and/or metals for the last 30 years.
- 3) I received a Ph.D. degree in Ceramics from Sheffield University, which is located in Sheffield in the United Kingdom.
- 4) I am the author of 20 papers in the field of ceramics and/or metals.
- 5) I am listed as an inventor on 31 U.S. patents and foreign patents, particularly relating to products and methods related to ceramics, metals and their processing.
- 6) I am very familiar with refractory filters as used in the casting of molten metals.
- 7) I have carried out and supervised numerous experimental and commercial trials concerning refractory filters.
- 8) I am the inventor of the subject matter described in the present application, U.S. Patent Application No. 10/516,438 ("the '438 application"), which was published as U.S. Patent Publication No 2005/0263449.

- 9) I have read and am familiar with the contents of this patent application and the Office Action dated May 1, 2009. I understand the nature of the obviousness rejections at issue in this application. In particular, the Office relies on U.S. Patent No. 5,520,823 (Jones) for allegedly teaching a filter comprising a carbon bonded network of graphitized carbon, the graphitized carbon being present in an amount up to 15% by weight and on U.S. Publication No. 2007/0090047 (Bell) for allegedly also teaching the graphitized carbon constituting the bonded network being present in an amount up to 15% by weight.
- 10) The filter as described in the '438 application and defined in independent claim 12 is made of a ceramic material comprising ceramic particles that are bound by a carbon bonded network of graphitized carbon. The graphitized carbon is prepared by heating a graphitizable carbon bonding precursor in a reducing or non-oxidizing atmosphere to a temperature of up to 1000 °C such that a continuous carbon bonded network is obtained. The carbon bonded network of graphitized carbon forms a continuous matrix into which are incorporated the ceramic particles. The terms "carbon bonded network" and "continuous matrix" are understood by the skilled artisan as being equivalent.
- 11) During firing, chemical bonds present in the graphitizable carbon bonding precursor are broken and new bonds are formed, thereby forming a carbon bonded network of graphitized carbon that surrounds ceramic particles which are therefore embedded in a carbon matrix.
- 12) Since firing is performed in a non-oxidizing or reducing atmosphere, the graphitizable carbon bonding precursor is not burnt off but is transformed into a carbon bonded network of graphitized carbon.
- 13) Graphite is a modification of carbon that is inert under the conditions claimed in claim 12 and as described in the '438 application. In particular, graphite does not form a carbon bonded network of graphitized carbon when heated in a reducing or non-oxidizing atmosphere to a temperature of up to 1000 °C.
- 14) The ceramic material of the filter further comprises fibers. By the addition of fibers the filter experiences a considerable increase in stability. It therefore is possible to use a low amount of graphitized carbon of only up to

15 wt% and nevertheless obtain a high stability of the filter also during steel casting.

- 15) I have read and reviewed U.S. Patent No. 5,520,823 to Jones, and have found that the product described therein differs from the product of the present invention.
- 16) Jones describes a filter made of a ceramic material comprising a substantially amorphous matrix of borosilicate glass in which is dispersed a crystalline phase comprising graphite and wollastonite. The ceramic material is formed by preparing an aqueous slurry containing the graphite, wollastonite, silica, borosilicate glass, one or more binders and optionally other components, as is described in column 2, lines 18 to 21.
- 17) The borosilicate glass used to produce the filters preferably has a softening temperature in the range of 600 °C, more preferably 650 °C to 900 °C and a melting temperature in the range of 700 °C to 1100 °C as is described in column 2, lines 38 to 41. According to column 2, lines 28 to 31 the aqueous slurry contains 35 to 50 % by weight of borosilicate glass.
- 18) After impregnation and drying the impregnated organic foam is fired at firing temperatures of preferably not exceeding 850 °C, usually in the range of 600 °C to 800 °C. This temperature is taken to avoid excessive oxidation of the graphite and amorphous carbon if present as is explained in column 3, lines 56 to 61. Further, according to column 3, lines 19 to 26, the composition used to produce the filter preferably contains up to 5 % by weight of silicon metal to reduce the tendency for some of the graphite to be lost due to oxidation during firing.
- 19) During firing, the organic foam used to produce the filter described by Jones is burnt off as is generally described in column 1, lines 12 to 18.
- 20) Although it is explained by Jones in column 3, lines 13 to 19, that amorphous carbon, such as carbon black may be contained in the composition which is used to produce the filter in an amount of usually up to about 5 % by weight, it is obvious to me, that at reaction conditions as described by Jones, such amorphous carbon will not form a carbon bonded network of graphitized carbon as present in the filter described in the application and claimed in claim 12.
- 21) Based on the information provided by Jones it is obvious to me, that the impregnated organic foam is fired with access to oxygen such that carbon

present in the impregnated foam is burnt off. Under the conditions described by Jones a carbon bonded network of graphitized carbon therefore will not form.

- 22) Contrary to this, the filter described in the application and claimed in claim 12 is fired in a reducing or non-oxidizing atmosphere such that a carbon bonded network of graphitized carbon can form.
- 23) The filter described by Jones does not comprise a carbon bonded network of graphitized carbon but instead comprises an amorphous matrix of borosilicate glass with crystalline particles of graphite dispersed therein.
- 24) Under the reaction conditions described by Jones, a carbon bonded network of graphitized carbon will not form due to the excess of borosilicate glass forming the substantially amorphous matrix and due to the presence of oxygen during firing.
- 25) I further have read and reviewed U.S. Patent Application No. 2007/0090047 A1 to Bell, which is a continuation of application No. 10/362,751, now U.S. Patent 7,138,084, and have found that the product described therein differs from the product of the present invention.
- 26) Bell describes a filter comprising particles of refractory material embedded in and bonded together by a carbon matrix material. However, to obtain sufficient stability during metal casting, a high amount of carbon matrix bonding material of at least 25 wt% is required.
- 27) In paragraph [0017] are described the relative proportions of particulate material to bonding material. As the narrowest range for the bonding material a range of approximately 35 – 25 % bonding material and approximately 65 – 75 % refractory is mentioned. Since the bonding material is formed during firing, the bonding material, e.g., does not comprise volatile compounds and, therefore, the relative amounts of the bonding material and of the refractory correspond to the amounts present in the filter. The range for the bonding material also corresponds to the amounts of Rauxolit and refractory used in example 1. According to paragraph [0099] Rauxolit levels from 45 to 25 % are used. In example 2, paragraph [0104], 40 wt% of nitric acid and heat treated Rauxolit FF and 60 wt% graphite are used. In example 3, paragraph [0106], 30 % by weight of nitric acid and heat treated Rauxolit FF and 70 % by weight of refractory material (alumina powder and graphite). The other components added to

the slurry (water, organic binder, thickener and suspension agent) will be volatilized during firing such that relative amount of Rauxolit and refractory corresponds to the percentage of bonding material and refractive material present in the filter.

- 28) In paragraph [0046] Bell mentions that it is preferred to use a binder containing from 0 to 50 weight %, preferably 0 to 20 weight % (based on total binder) of mesophase in the process for making the filter material. The percentage of mesophase refers to a binder used as a starting material. As is explained in more detail in paragraph [0043], the filter may be free from mesophase or can contain mesophase. Further, mesophase may be developed during firing.
- 29) However, mesophase is not equivalent to graphitizable carbon bonding precursor in the sense of the filter as claimed in claim 12. The term "graphitizable carbon bonding precursor" is comparable to the term "binder" as used by Bell.
- 30) A filter as described by Bell therefore contains at least 25 % by weight of graphitizable carbon bonding precursor.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced application or any patent issuing thereon.

Date

28/July/2009

Dr. Kassim Juma

Juma